PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2003-178896**
(43)Date of publication of application : **27.06.2003**

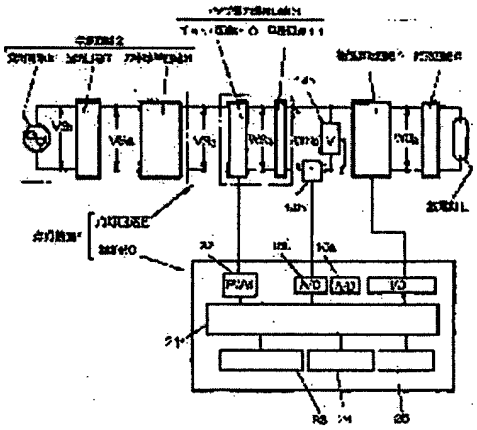
(51)Int.Cl. **H05B 41/282**

(21)Application number : **2001-375236**
(22)Date of filing : **10.12.2001**

(71)Applicant : **IWASAKI ELECTRIC CO LTD**
(72)Inventor : **MATSUMOTO MINORU**
IIDA TAKENOBU

(54) LIGHTER FOR DISCHARGE LAMP

(57)Abstract:
PROBLEM TO BE SOLVED: To make it continuously lighting by generating the lamp lighting alternate-current electric power of the arbitrary waveform according to the characteristic of an electric discharge lamp by very easy composition, and moreover, with small size and low cost, and by impressing it to the electric discharge lamp.
SOLUTION: Direct current voltage is converted to direct current rectangle wave electric power by making a switching element (9) of a chopper circuit (10) ON-OFF by an electric power control pulse signal of the duty ratio, which changes according to the target direct-current electric power of the waveform, which is the rectified target alternate current electric power. By making this flat and smooth in a smoothing circuit (11), it is converted to an adjusting direct current power of the waveform equal to the target direct current electric power. Furthermore, by reversing it in a polar reversing circuit (4) synchronizing this with target alternate current electric power, it is made so that the alternate current electric power for lamp lighting of the waveform equal to the target alternate current electric power may be impressed to the electric discharge lamp (L).



LEGAL STATUS

[Date of request for examination] 18.11.2004

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]

[Claim 1] The lamp power equalization circuit which consists of a smoothing circuit (11) which graduates the chopper circuit (10) which changes into direct-current square wave power the direct-current constant voltage outputted from the power circuit (2) by turning on and off of a switching element (9), and its direct-current square wave power (3), It is the lighting device of the electric-discharge lamp equipped with the polarity-reversals circuit (4) which is made to reverse the adjustment direct current power outputted from the lamp power equalization circuit (3) concerned to the timing of arbitration, and generates the alternating current power for lamp lighting. A power wave setting means to set up beforehand the wave of the target alternating current power which should be impressed to a electric-discharge lamp (L) (23), The lamp electrical-power-control means made to turn on and off the switching element (9) of said chopper circuit (10) by the power control pulse signal of the duty ratio set up based on a power value at the moment of the ability to set at the minute section of the target direct current power which rectified said target alternating current power (24), The lighting device of the electric-discharge lamp characterized by having a timing control means (25) to output the timing control signal which synchronizes the outputted adjustment direct current power with said target alternating current power, and reverses it from said lamp power equalization circuit (3) to said polarity-reversals circuit (4).

[Claim 2] The lighting device of the electric-discharge lamp [equipped with a duty ratio amendment means (STP7) by which said lamp electrical-power-control means (24) carries out feedback control of the duty ratio of the power control pulse signal made to turn said switching element (9) on and off based on the difference of the moment power value of the adjustment direct current power outputted from said smoothing circuit (11), and the moment power value of said target direct current wave] according to claim 1.

[Claim 3] The lighting device of the electric-discharge lamp according to claim 1 formed so that a power wave setting means (23) might be the memory chip which recorded the wave of the target alternating current power which should be impressed to a electric-discharge lamp

(L) and said lamp electrical-power-control means (24) might be equipped with it exchangeable through a connector.

[Claim 4] The lighting device of the electric-discharge lamp according to claim 1 which is the memory on which a power wave setting means (23) records the wave of the target alternating current power supplied by the means of communications on which target alternating current power is made to record from an external computer.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the lighting device which carries out continuation lighting of the electric-discharge lamp, after starting electric-discharge lamps, such as a fluorescent lamp, a low-pressure sodium lamp, a high-pressure mercury lamp, an extra-high pressure mercury lamp, a metal halide lamp, a ceramic metal halide lamp, and a high-pressure sodium lamp.

[0002]

[Description of the Prior Art] after starting a electric-discharge lamp, in order to make the light switch on continuously -- the former -- a direct current of the electrical-potential-difference value of arbitration -- a law -- it is common by reversing power a predetermined period to generate alternating current square wave power as shown in drawing 9 (a), and to supply this alternating current square wave power to a electric-discharge lamp.

[0003] Although wave-like control was easy for this alternating current square wave power and there was an advantage that there was little fluctuation of light, within a half period, according to the experiment of an artificer, it became clear that an alternating current square wave could not necessarily say it as the optimal power wave depending on the class or property of a lamp.

[0004] For example, when a electric-discharge lamp is made to supply and turn on alternating current square wave power, since big current variation is produced at the time of reversal of positive/negative, even if a suspension inductance is small, the high voltage occurs, CHIRATSUKI of a lamp is produced or there is a possibility that the capacitor of a starter may be destroyed, in the internal starting mold lamp having a starter.

[0005] If alternating current trapezoidal wave power as shown in drawing 9 (b) is supplied in order to prevent this, since a current will be gradually changed at the time of reversal of positive/negative, big voltage variation which was mentioned above does not arise.

[0006] Moreover, if pulse shape which makes a power value high just before reversal of alternating current square wave power is added or it is made a serration wave which falls

from the standup of alternating current square wave power, and makes the power value high gradually just before as shown in drawing 9 (c) and (d) When the hot spot on an electrode occurs strongly, inter-electrode discharge is stabilized, and it is effective in removing the metal deposit generated on the electrode when it supplied an extra-high pressure mercury lamp and it there is not only effectiveness of CHIRATSUKI prevention, but was switched on, and there is an advantage referred to as that a lamp life is prolonged.

[0007] There is an advantage that the screen of uniform brightness is obtained, in a wave as especially shown in drawing 9 (d), without the brightness of a screen changing partially, even if it uses it for a liquid crystal projector since a power value changes gradually.

[0008]

[Problem(s) to be Solved by the Invention] However, if it is going to generate the power wave of arbitration in this way, since the function generator which carries out the 1 number also of 100,000 yen is required and the magnitude moreover also has a small thing also about 50cmx30cmx10cm, it is difficult also in tooth space also in cost to include this in the lighting device of each electric-discharge lamp, and it is not realistic at all.

[0009] Then, this invention is a very easy configuration, moreover are small and low cost and makes it the technical technical problem to generate the lamp lighting alternating current power of an arbitration wave according to the property of a electric-discharge lamp, to impress this to a electric-discharge lamp, and to be able to be made to carry out continuation lighting.

[0010]

[Means for Solving the Problem] In order to solve this technical problem, invention of claim 1 The lamp power equalization circuit which consists of a smoothing circuit which graduates the chopper circuit which changes into direct-current square wave power the direct-current constant voltage outputted from the power circuit by turning on and off of a switching element, and its direct-current square wave power, It is the lighting device of the electric-discharge lamp equipped with the polarity-reversals circuit which is made to reverse the adjustment direct current power outputted from the lamp power equalization circuit concerned to the timing of arbitration, and generates the alternating current power for lamp lighting. A power wave setting means to set up beforehand the wave of the target alternating current power which should be impressed to said electric-discharge lamp, The lamp electrical-power-control means made to turn on and off the switching element of said chopper circuit by the power control pulse signal of the duty ratio set up based on the wave of the target direct current power which rectified said target alternating current power, It is characterized by having a timing control means to output the timing control signal which synchronizes the outputted adjustment direct current power with said target alternating current power, and reverses it from said lamp power equalization circuit to said polarity-reversals circuit.

[0011] According to invention of claim 1, the switching element of a chopper circuit is turned on and off by the power control pulse signal outputted from the lamp electrical-power-control means according to the duty ratio of said power control pulse signal. Since this duty ratio is set up based on the target direct current power which rectified target alternating current power, PWM control of the direct-current constant voltage outputted from the power circuit is carried out in a chopper circuit, it is changed into direct-current square wave power, and wave-like adjustment direct current power equal to the target direct current power which rectified target alternating current power is obtained by graduating this in a smoothing circuit. Therefore, if the obtained adjustment direct current power is synchronized with said target alternating current power by the polarity-reversals circuit and is reversed, the wave-like alternating current power for lamp lighting equal to target alternating current power will be obtained.

[0012] Invention of claim 2 is equipped with the control pulse generation means which carries out feedback control of the duty ratio of the power control pulse signal which makes said lamp electrical-power-control means turn said switching element on and off based on the difference of the moment power value of the adjustment direct current power outputted from said smoothing circuit, and the moment power value of the target direct current power which rectified target alternating current power.

[0013] The moment power value of the adjustment direct current power with which the duty ratio of a power control pulse signal was outputted from said smoothing circuit according to invention of this claim 2, Since feedback control is carried out based on a difference with the moment power value of the target direct current wave which rectified target alternating current power By graduating the direct-current square wave power by which PWM control was carried out, the adjustment direct current power which was correctly in agreement with target direct current power is obtained, and the alternating current power for lamp lighting of the wave which was in agreement with this target alternating current power and accuracy is obtained by making it synchronize with target alternating current power, and making it further reversed.

[0014] Moreover, if the memory chip on which the target alternating current power which should be impressed to a electric-discharge lamp as a wave setting means was made to record like invention of claim 3 is used, a setup and modification of target alternating current power can be easily made by exchanging memory chips.

[0015] If the memory which similarly records the wave of the target alternating current power supplied from an external computer as a wave setting means like invention of claim 4 is used, a setup and modification of target alternating current power can be easily made by easy actuation.

[0016]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is

concretely explained based on a drawing. The flow chart with which the block diagram showing the lighting device of the electric-discharge lamp which drawing 1 requires for this invention, the circuit diagram in which drawing 2 shows a lamp power equalization circuit, the circuit diagram in which drawing 3 shows a polarity-reversals circuit, the wave form chart in which drawing 4 shows each power wave and each control pulse signal, drawing 5 , or drawing 7 shows procedure, and drawing 8 are the wave form charts explaining duty ratio amendment processing.

[0017] The lighting device 1 of the electric-discharge lamp of this example consists of a control section C which makes the alternating current power for lamp lighting which was in agreement with the target alternating current power which carried out the moveable cooking stove toll of the lighting circuit E which makes a electric-discharge lamp L turn on, and the lighting circuit E concerned, and set them up beforehand generate.

[0018] The power circuit 2 where the lighting circuit E outputs a direct-current constant voltage, and the lamp power equalization circuit 3 which lowers the pressure of the direct-current constant voltage, and obtains the adjustment direct current power of a request wave, It has the polarity-reversals circuit 4 which is made to reverse the adjustment direct current power outputted from the lamp power equalization circuit 3 concerned to the timing of arbitration, and generates the alternating current power for lamp lighting, and the starting circuit 5 which impresses the high-pressure starting voltage of several kV - dozens of kV when the starting switch of a electric-discharge lamp L is turned on.

[0019] The power circuit 2 is equipped with the rectifier circuit 7 which rectifies the sine alternating voltage VS 1 supplied from AC power supply 6, and the power-factor-improvement circuit 8 which changes the rectified pulsating voltage VS 2 into the direct-current constant voltage VS 3.

[0020] The lamp power equalization circuit 3 is equipped with the chopper circuit 10 of the preceding paragraph which changes into the direct-current square wave power WS 4 the direct-current constant voltage VS 3 outputted from the power circuit 2, and the smoothing circuit 11 of the latter part which graduates this direct-current square wave power WS 4, and outputs the desired adjustment direct current power WS 5 by turning on and off FET (field-effect transistor)9 used as a switching element.

[0021] The adjustment direct current power WS 5 equal to the target direct current power WD0 which rectified the target alternating current power WA0 is obtained by making FET9 allotted to the chopper circuit 10 turn on and off, making the direct-current square wave power WS 4 of the duty ratio corresponding to the target alternating current power WA0 output, and passing a smoothing circuit 11 with the power control pulse signal PW specifically supplied through driver 9a from the PWM control circuit 22 of a control section C mentioned later.

[0022] The polarity-reversals circuit 4 is formed in the full bridge type equipped with four

FET (field-effect transistor) 12A-12D used as a switching element, changes into the alternating current power WS 6 for lamp lighting the adjustment direct current power WS 5 impressed to 4 inches of input terminals, and outputs it to output terminal 4out.

[0023] For this reason, turning on and off is switched to predetermined timing for each set by the polar control pulse signal (timing control signal) PA supplied from the control section C mentioned later - PD, using each as one pair FET12A, and two 12B, 12C and 12D located in a vertical angle.

[0024] Each FET 12A-12D is each polar control pulse signal PA - PD. Since it will be in switch-on and will be in non-switch-on at the time of a low when it is a high level, each polar control pulse signal PA-PD is outputted according to the timing by which each FET 12A-12D is turned on and off.

[0025] A control section C consists of single chip microcomputers 21 etc. to the input side The sensors 14a and 14b which detect the electrical potential difference and current of the adjustment direct current power WS 5 which were outputted are connected through A/D converters 15a and 15b from the lamp power equalization circuit 3. To an output side While FET9 of a chopper circuit 10 is connected through the PWM control circuit 22 and driver 9a, FET 12A-12D of the polarity-reversals circuit 4 is connected through Drivers 12a-12d.

[0026] Moreover, while the memory 23 used as a power wave setting means to set beforehand the wave of the target alternating current power WA0 which should be impressed to a electric-discharge lamp L to a control section C is formed The lamp electrical-power-control means 24 which makes the adjustment direct current power WS 5 in agreement with the target direct current power WD0 by outputting the power control pulse signal PW to said chopper circuit 10, It has a timing control means 25 to output polar control pulse signal PA-PD which synchronizes the outputted adjustment direct current power WS 5 with said target alternating current power WA0, and reverses it from said lamp power equalization circuit 3 to said polarity-reversals circuit 4.

[0027] The thing of the type which detaches and attaches the memory chip on which the wave of the target alternating current power which can adopt the type of arbitration, for example, should be impressed to a electric-discharge lamp L was made to record to a control section C through a connector (not shown), and the type which can rewrite the wave of target alternating current power by means of communications from the external computer connected to a control section C, can set up, or can be installed is sufficient as memory 23.

[0028] The wave signal WD which rectified that one period when this memory 23 was made to memorize the target alternating current power WA0 and the wave signal WA which has the wave profile of equivalence is registered, and if the power multiplier K beforehand set as this is applied, the wave of the target direct current power WD0 equal to the power value which rectified the target alternating current power WA0 will be acquired.

[0029] And while the time amount by which n division into equal parts of the target direct

current power WD0 is done, and it is equivalent to a 1/n period is set up as m times (about 1<=m<=1000) of the pulse period PC of the power control pulse signal PW According to Power Mi and the direct-current constant voltage VS 3 outputted from a power circuit 2, the duty ratio DTi of each power control pulse signal PWi is set up at the target moment according to the wave high level of the target direct current power WD0 of an index i= 1 - n.

[0030] Drawing 5 - drawing 7 are flow charts which show the procedure of the lamp electrical-power-control means 24. first, if a electric-discharge lamp L starts, the program shown in drawing 5 will carry out activation initiation -- having -- first -- a step STP 1 -- an index i= 1 -- the total -- it places with the time of day T= 0 of the timer which shifts to a step STP 2 and measures a pulse period as electric-energy TW=0.

[0031] The PWM control circuit 22 of a control section C is set up so that the pulse of the pulse width PLi which computes pulse width PLi=DTixPC of the pulse PWi of each [read-out and a step STP 4] for a duty ratio DTi and the pulse period PC at a step STP 3, and serves as the power control pulse signal PW at a step STP 5 may be outputted.

[0032] Subsequently, the time of day T which carried out timer measurement at a step STP 6 performs the duty ratio amendment program (refer to drawing 6) of waiting and a step STP 7 for passing [m times as much as the pulse period PC] by time amount. Furthermore, it judges whether it shifted to a step STP 8 and processing for one period of the target alternating current power WA0 was completed.

[0033] This judgment is made by distinguishing whether it is i=n. And when it is judged that it has not ended, the processing which rewrites with index i=i +1 at a step STP 9, and outputs return and the following power control pulse signal to a step STP 2 is continued. Moreover, when it is judged that it ended, after performing the power multiplier amendment program (refer to drawing 7) of a step STP 10, it returns to a step STP 1.

[0034] Drawing 6 shows the concrete procedure of the duty ratio amendment program of said step STP 7, and the power control pulse signal PW is m pulse output for being carried out, amending a duty ratio so that the adjustment direct current power WS 5 with which time of day T was outputted from the lamp power equalization circuit 3 whenever [m times as much as the pulse period PC] it passed by time amount may become equal to target direct current power, and performing feedback control.

[0035] Here, while incorporating the electrical potential difference Vi detected by Sensors 14a and 14b at a step STP 11, and Current Ii, the wave configuration value Fi and the power multiplier K are read at a step STP 12, and power Mi=KxFi and total electric-energy TW=TW+Wi are computed at a step STP 13 based on these values at moment power Wi=VixIi of the adjustment direct current power WS 5, and the target moment. The pulse width PLi of Power Mi, the wave signal WD, and the that wave configuration value Fi, an electrical potential difference Vi, Current Ii, the power multiplier K and the power control pulse signal PW and the relation between the pulse period PC and a duty ratio DTi are

shown in drawing 8 at Power Wi, the target direct current power WD0, and its target moment the direct-current constant voltage VS 3 and the adjustment direct current power WS 5, and the moment at this time.

[0036] Subsequently, difference dW=Wi-Mi with Power Mi is computed at Power Wi and the target moment at the moment at a step STP 14. Here, since Power Wi is smaller than Power Mi at the target moment at the moment, in the case of dW<0, shift to a step STP 15, it makes a duty ratio DTi increase according to the value of dW, and is rewritten. Moreover, since Power Wi is larger than Power Mi at the target moment at the moment, in the case of dW>0, it shifts to a step STP 16, it decreases a duty ratio DTi according to the value of dW, and is rewritten. Furthermore, in the case of dW=0, processing is ended, without rewriting a duty ratio DTi, since Power Wi is equal to Power Mi at the target moment at the moment.

[0037] Whenever the concrete procedure of the power multiplier amendment program of said step STP 10 is shown and processing for one period of the target alternating current power WA0 is completed, drawing 7 is for amending the power multiplier K and performing feedback control so that the total electric energy TW for the one period may become equal to the setting electric energy SW set up beforehand every.

[0038] Here, the total electric energy TW computed at the previous step STP 13 and the setting electric energy SW set up beforehand are computed at a step STP 21, and the difference dT=TW-SW is computed at read-out and a step STP 22. And since the total electric energy TW is smaller than the setting electric energy SW, in the case of dT<0, shift to a step STP 23, it makes the power multiplier K increase according to the value of dT, and is rewritten. Moreover, since the total electric energy TW is larger than the setting electric energy SW, in the case of dT>0, it shifts to a step STP 24, it decreases the power multiplier K according to the value of dT, and is rewritten. Furthermore, since the total electric energy TW is equal to the setting electric energy SW in the case of dT=0, processing is ended, without rewriting the power multiplier K.

[0039] The above is the example of 1 configuration of this invention, and explains the operation below. First, the wave signal WD which rectified the one period when the wave signal WA of the target alternating current power WA0 which goes up gradually toward falling in the memory 23 of a control section C from a standup was made to memorize is registered, and if the power multiplier K is applied to this, the wave of the target direct current power WD0 equal to the power value which rectified the target alternating current power WA0 will be acquired.

[0040] And n division into equal parts of the target direct current power WD0 is done, and while the time amount equivalent to a 1/n period is set up as m times (about 1<=m<=1000) of the pulse period PC of the power control pulse signal PW, according to Power Mi and the direct-current constant voltage VS 3 outputted from a power circuit 2, the duty ratio DTi of each control pulse signal PWi is set up at the target moment according to each wave of an

index i= 1 - n.

[0041] Here, if a electric-discharge lamp L is started, it will be rectified in a rectifier circuit 7, and the sinusoidal alternating voltage VS 1 outputted from AC power supply 6 will turn into pulsating voltage VS 2, will be changed into the direct-current constant voltage VS 3 in the power-factor-improvement circuit 8, and will be supplied to a chopper circuit 10. On the other hand, the power control pulse signal PW is inputted into a chopper circuit 10 from a control section C, and on-off control of FET9 is carried out to it. From the standup of the target alternating current power WA0, the duty ratio DTi of the power control pulse signal PW is set up so that pulse width PLi may become large gradually toward falling, and it is turned on and off so that the flow time amount of FET9 may become long gradually according to this duty ratio DTi.

[0042] Therefore, the adjustment direct current power WS 5 which pulse width is becoming large gradually toward the standup of the target alternating current power WA0 to falling, and the direct-current square wave power WS 4 outputted from this chopper circuit 10 inputted this into the smoothing circuit 11, and was graduated serves as a wave equal to the target direct current power WD0, and is inputted into the polarity-reversals circuit 4.

[0043] In the polarity-reversals circuit 4, since FET 12A-12D is turned on and off by the polar control pulse signal PA - PD synchronizing with the reversal timing of the target alternating current power WA0, the adjustment direct current power WS 5 is changed into the wave-like alternating current power WS 6 for lamp lighting equal to the target alternating current power WA0.

[0044] Thus, since the wave-like alternating current power WS 6 for lamp lighting equal to the target alternating current power WA0 of the arbitration set up beforehand is generable, the light can be made to switch on on the optimal conditions by setting up the optimal target alternating-current-power WA0 wave according to the property of the electric-discharge lamp L.

[0045] In addition, whenever each m pulses of the power control pulse signal PW are outputted from a control section C to a chopper circuit 10 At the moment of the electrical potential difference and current of the adjustment direct current power WS 5 being detected by Sensors 14a and 14b, and being calculated based on this, Power Wi, At the target moment, based on Power Mi, a duty ratio DTi will be amended according to the procedure shown in drawing 6 , and feedback control will be carried out so that the wave of the adjustment direct current power WS 5 may be in agreement with the target direct current power WD0.

[0046] Moreover, since the total electric energy TW is computed every according to the procedure shown in drawing 7 , it is compared with the setting electric energy SW set up beforehand and the power multiplier K is amended whenever control for one period of the target alternating current power WA0 is completed, feedback control will be carried out so that the total electric energy TW may be in agreement with the setting electric energy SW.

[0047] in addition, in above-mentioned explanation <A HREF="/Tokujitu/tjitemdrw.ipdl?N0000=240&N0500=1 E_N/;>:>87769///&N0001=940&N0552=9&N 0553= 000011" TARGET="tjitemdrw"> drawing 9 Although the case where the wave-like alternating current power for lamp lighting of (d) was supplied was explained, the wave may be arbitrary and may be an unsymmetrical wave from which it is a plus and minus side and a power value and impression time amount differ not to mention a wave as shown in drawing 9 (b) and (c). Moreover, although above-mentioned explanation explained the case where power was adjusted, power adjustment may be carried out by controlling either an electrical potential difference or a current. Furthermore, like the wave of drawing 9 (b) - (d), when a plus [of the alternating current power WA0 for lamp lighting] and minus side is equal, one period may be controlled based on the wave for a half period.

[0048]

[Effect of the Invention] Only by setting up the duty ratio of the power control pulse signal which turns the switching element of a chopper circuit on and off based on the target direct current power which rectified target alternating current power according to this invention, as stated above Wave-like adjustment direct current power equal to target direct current power is outputted from a lamp power equalization circuit. If this is reversed to predetermined timing, the wave-like alternating current power for lamp lighting equal to target alternating current power will be obtained simply. Moreover, these control Since it can perform with easy control units, such as a single chip microcomputer in which inclusion in the usual lighting circuit is possible The configuration of the whole equipment can be simplified and miniaturized and the effectiveness which was very excellent that the power of an arbitration wave according to the property of a electric-discharge lamp is generable by low cost is done so.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the lighting device of the electric-discharge lamp concerning this invention.

[Drawing 2] The circuit diagram showing a lamp power equalization circuit.

[Drawing 3] The circuit diagram showing a polarity-reversals circuit.

[Drawing 4] The wave form chart showing each power wave and each control pulse signal.

[Drawing 5] The flow chart which shows procedure.

[Drawing 6] The flow chart which shows a duty ratio amendment procedure.

[Drawing 7] The flow chart which shows a power multiplier amendment procedure.

[Drawing 8] The wave form chart explaining duty ratio amendment processing.

[Drawing 9] The wave form chart showing lamp lighting alternating current power.

[Description of Notations]

1 ..... Lighting device

L ..... Electric-discharge lamp

2 ..... Power circuit

3 ..... Lamp power equalization circuit

4 ..... Polarity-reversals circuit

9 ..... FET (switching element)

10 ..... Chopper circuit

11 ..... Smoothing circuit

23 ..... Power wave setting means

24 ..... Lamp electrical-power-control means

25 ..... Timing control means